Asphalt Institute Quarterly

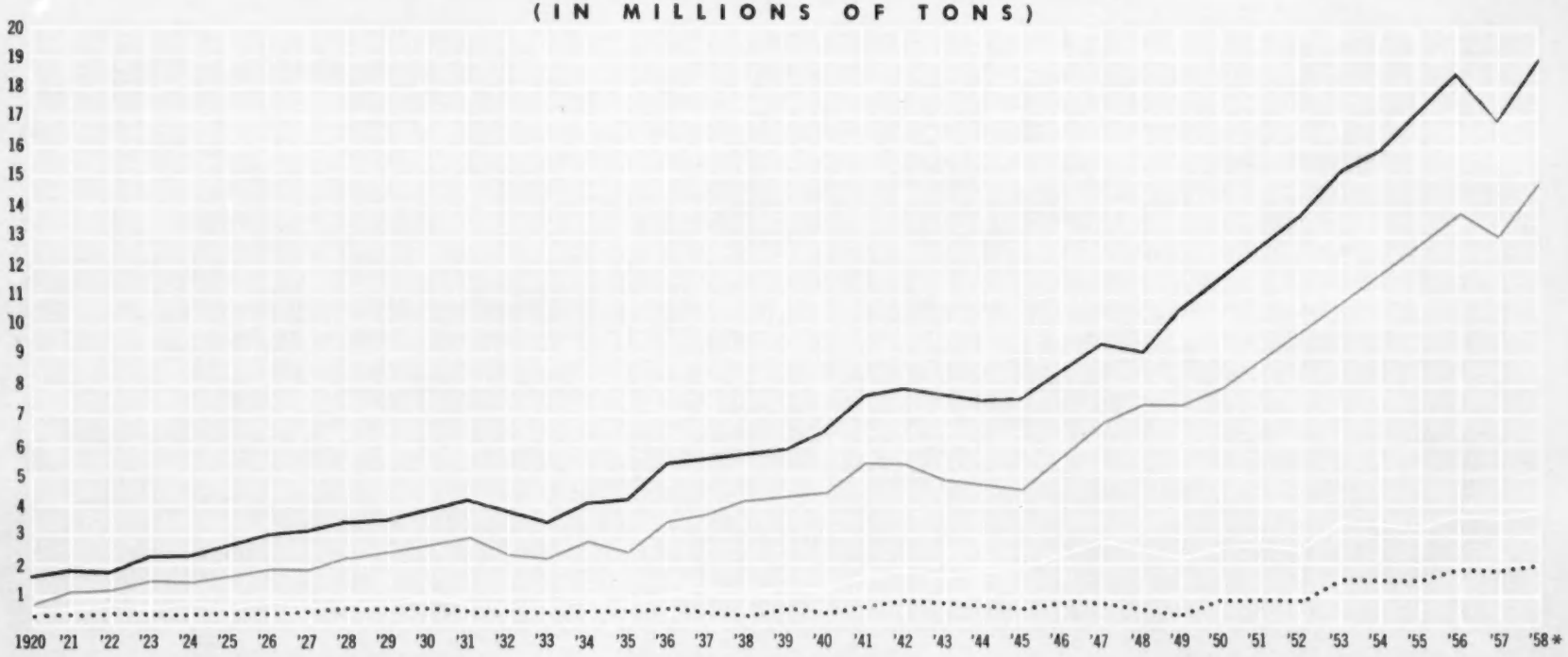
APRIL, 1959

In this issue:

ASPHALT IN HYDRAULIC STRUCTURES

Annual Sales of Petroleum Asphalt and Road Oil to Domestic Consumers in U.S.A.

(IN MILLIONS OF TONS)



TOTAL SALES	100%
PAVING	74.4%
ROOFING	17.8%
MISCELLANEOUS	7.8%

SOURCE: U. S. BUREAU OF MINES ANNUAL FIGURES
CHARTED BY THE ASPHALT INSTITUTE MARCH 1959

* UNOFFICIAL: BASED ON PRELIMINARY ESTIMATES

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ASPHALTOPICS

ASPHALT INSTITUTE Quarterly

Volume 11, No. 2 April, 1959

Glynn Harvey
Editor

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Robert J. Lowe
Assistant Editor

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We dislike to make odious comparisons because we are, by nature, as friendly and loving as a sheep-dog. But a sense of journalistic integrity compels us to pass along a bit of intelligence from our aircraft spotter in Minnesota. He reports that a number of panels of slab pavement at Duluth Air Force Base have had to be replaced before any traffic was placed on them. Meanwhile, at the same base, they're tearing up a perfectly good asphalt-paved runway and replacing it with more slabs. It sort of makes a feller wonder as he thumbs through his Federal Income Tax instructions . . .

A little buoyant boasting is invigorating when it reflects a pride in craftsmanship For instance, when the R. E. Hazard Company of San Diego finished paving a section of U.S. 101 within the city limits, the firm promptly hung out its professional shingle, advertising another snug-fit asphalt pavement.

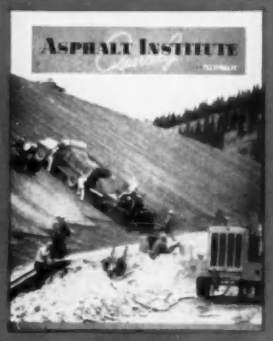
The largest single freeway contract ever awarded in California involved some 250,000 tons of plant-mixed asphalt paving for the 29.3-mile link between Barstow and Victorville. Specs called for three inches of dense-graded surfacing material plus a half-inch of open-graded surfacing to delineate the traffic lanes and provides an improved wearing surface. The mix, turned out by two batch plants operating cheek-by-jowl, went for $2.40 per ton. Total bid cost of the project, handled by Fredericksen & Kasler, was $5.75 million—nearly a million dollars below the second lowest bidder and more than $3 million under the high bid.

Of course, speaking of smooth pavements, it's always a source of annoyance to us when the maintenance crews go to a lot of trouble to erect a "Slippery When Wet" sign alongside an old-style "blacktop" road (instead of restoring skid-resistance by giving it a textured surface treatment). That's why the sign posted on the remaining concrete section of the Pennsylvania Turnpike warms the old asphalt-paved cockles of our heart.

The Monsanto Chemical Company is building eleven miles of road to link its phosphate mine and its phosphorus plant at Soda Springs, Idaho. Built to accommodate the heaviest truck loads in the United States (gross weight of about 100 tons), the road will be asphalt-paved, of course—four inches of crushed slag mix on six inches of crushed slag and quartzite chips on thirty inches of phosphorus slag ballast.

Cover

Our cover picture is a view of the Montgomery Dam, believed to be the first high rock-filled dam ever constructed with an asphalt concrete face. A second dam of this type is reported under consideration for the Roanoke River in Virginia.



The Asphalt Institute Quarterly is published by the Asphalt Institute, an international, nonprofit association sponsored by members of the petroleum asphalt industry to serve both users and producers of asphaltic materials through programs of engineering, research and education.

The member companies of the Institute, who have made possible the publication of this magazine, are listed on page 15.

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WHEN IT'S SPRINGTIME

the World's First ASPHALT-Faced High DA

IT'S SPRINGTIME in the Rockies. The melting snows are beginning to swell the headwaters of the Blue River where they gather on the western slope of the Continental Divide. And precious water is flowing eastward through a mountain tunnel into a reservoir that backs up behind one of the most unusual dams in the world.

The Montgomery Dam, near the rim of the Divide, two miles above sea level, is the first rock-filled dam ever constructed in the United States—and probably in the world—with an asphalt concrete facing.

The reservoir holds 5100 acre-feet of water which is fed by gravity flow to the thirsty city of Colorado Springs. By design, the height of the 113-foot high dam may be increased by as much as fifty feet, doubling the capacity of this man-made lake.

SKY-HIGH PROJECT

This is a rock-fill dam. It differs from the conventional rock-fill dam because of its asphalt face, laid to a thickness of twelve inches in three compacted courses on a slope of 1 (vertical) on 1.7 (horizontal). And there were perfectly logical engineering reasons why the city engineers and the consulting firm of F. W. Schedienhelm and Associates turned to asphalt for this sky-high project.

SHORT CONSTRUCTION SEASON

To begin with, at these altitudes with their relatively low temperatures, the construction season is short. This fact, coupled with the long haul involved in bringing cement to the isolated mountain site, virtually ruled out the conventional structure. Further, the engineers recognized that the cost of building a portland cement concrete dam would be intolerable.

On the other hand, there was an abundance of suitable rock at the site which made a rock-fill dam desirable—and the asphalt concrete face feasible from the engineering standpoint. Finally, there was a clear-cut savings of at least fifty percent in construction cost.

Yet, the decision to embark on this novel adventure in asphalt technology raised some critical questions and drove the consultants to the laboratory for answers. There were

IE IN THE ROCKIES

DA is a triumph of Imagineering

questions about the behavior of asphalt concrete under special conditions, questions that called for the development of new tests and new design methods.

For example, how would an asphalt mix twelve inches thick behave when laid on relatively steep slope? There were no guide-posts. What would be the effect of freezing and thawing, and wave action? What about flow of the mix under high temperature? For the special conditions which applied there were no ready answers.

How rich an asphalt mixture would be needed, and in what thicknesses should it be laid, to retain its essential texture and impermeability? Would it crack? Would it slump? Would the plucking action of winter ice affect it?

These were just some of the questions the engineers asked themselves and, finding no answers, they turned to the laboratory. Out of these studies, consuming more than two years, was born a solid conviction that a properly designed mix, carefully laid in sufficient thickness on a suitable stone base, could be applied on slopes as steep as 1 on 1.5 and be expected to remain stable, even at surface temperatures as high as 140°F.

STARTED IN 1954

Construction of the dam was started in the summer of 1954 and completed three years later—although, due to the brief and uncertain construction season, actual working time involved covered only about 18 months. Work began with the quarrying of the rock from the adjacent granite mountainside. The rock fill was placed by dumping, and each load was sluiced with a high pressure stream of water aimed at achieving maximum initial settlement of the rock.

After acceptable height and degree of slope was achieved on the upstream face of the fill, layers of smaller rock (¾″-3″) were placed and compacted to form a fairly smooth base surface. After experimenting, it was found that proper compaction could best be achieved by using a vibratory roller and this method was used to compact the finished base near the end of the 1956 working season.

Bids were received that November for placing the asphalt concrete face in 1957. This gave the contractor all winter to study the problem and make necessary modifications in his equipment. The contractor made good use of this period to

design and build a novel turntable, tractor-drawn, which was to serve admirably for positioning and moving trucks and paving machine on the crest of the dam.

Originally, it had been hoped that the compacted and asphalt-treated base course would support the operations of the asphalt paver. But this proved a false hope, and it was found necessary to hand place a leveling course, ranging in thickness from one to about three inches.

RACE AGAINST CALENDAR

Spring was late in coming to the higher slopes of the Rockies in 1957, cutting down the construction season and making the final critical stages of work a race against time. This was the kind of challenge that asphalt, as a construction material, welcomes. Between July 22 and September 24, the 27,770 square yards of asphalt concrete face were placed and compacted.

The paving technique followed the familiar pattern for slope paving: the asphalt spreader and its supply trucks were controlled by cables and winch, as was the vibrating roller which compacted the mix into successive layers of four inches, 3½ inches and three inches. To the leveling course was attributed a thickness value, over-all of 1½ inches.

A concrete cut-off wall, three feet wide and ranging in depth between three and eight feet, followed the general contour of the dam base a short distance upstream. This permitted the asphalt face to be carried down to a horizontal plane and continued over the top of the cut-off wall to a point a few feet upstream where it was extended down into the compacted backfill. The result was to increase the area of asphalt concrete bonded to the portland cement concrete cut-off wall, diminishing the chance of leakage between the face and the cut-off.

The Montgomery Dam, now emerging from its second winter of service in sound condition, has proved the feasibility of economical dam construction in areas where there is no readily available material for a rolled-earth-fill type or portland cement concrete masonry, but where there is a good supply of rock suitable for rock fill.

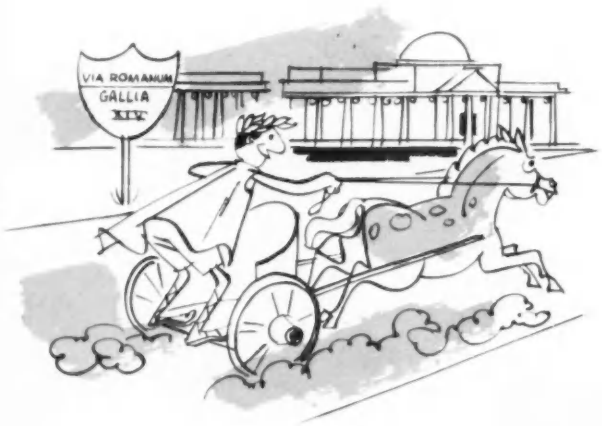
SETTLEMENT SLIGHT

Settlement has been negligible and the rich asphalt mixture (8.5 percent paving grade asphalt by weight of dried aggregate) has shown no evidence of serious cracking, although this possibility was not discounted in the planning. Such minor surface cracks as were disclosed when the reservoir level was last drawn down were of the self-healing type.

Up there in the snow-mantled peaks of the Rocky Mountains, asphalt is proving once again its right to be identified as "Nature's most versatile product."

A winch-operated vibrating compactor was used on the slope.

ROME STILL BUILDING ROADS



Time was when all roads led to Rome, and Roman highway engineering was the marvel of the age. Well, a lot of chariots have passed over the bridge since then, but Italy is still in the road-building business. Our July issue will feature the new asphalt-paved "Highway of the Sun" between Rome and Naples. Opening in June, it will be the first 100-mile leg of a projected superhighway that will swing down from Milan to the heel of the Italian boot. Back home here, we will revisit the first Federal-aid project in West Virginia. This is the asphalt-paved road running from Roncevert to Lewisburg. Constructed in 1917, much of this original pavement is still in use and in good condition. An Interstate paving project in the Midwest and an asphalt subsealing program on New York State slab pavements will be examined, and we'll visit Maumee, Ohio, which is rehabilitating its entire street system.

UNDER THE HEADING OF •

UNFINISHED BUSINESS

New Jersey groin project stalled by winter

THE TOWN of Harvey Cedars, New Jersey, lost a race against time and tide last December, but by the time this issue of the *Quarterly* reaches you, the little resort town which lies on a thin spit of land between Barnegat Bay and the Atlantic Ocean may have completed its shore protection project.

Borrowing a page from the Maryland State Roads Commission's design book, the Jersey town contracted to build three asphalt groins similar to those constructed in 1956 and 1957 at Ocean City, Maryland. But winter, complete with a howling snow storm and a raging tide, slammed the door on the work crew at Harvey Cedars after they had laid down the first groin.

FROZEN OUT

In fact, plummeting temperatures made it impossible to complete construction of the first installation in one day and work was carried over into the second day. The second groin was then begun, but the weather worsened, with snow and high tides, and the entire project was abandoned until spring. The unused asphalt mix was diverted to make a haul road to the construction site.

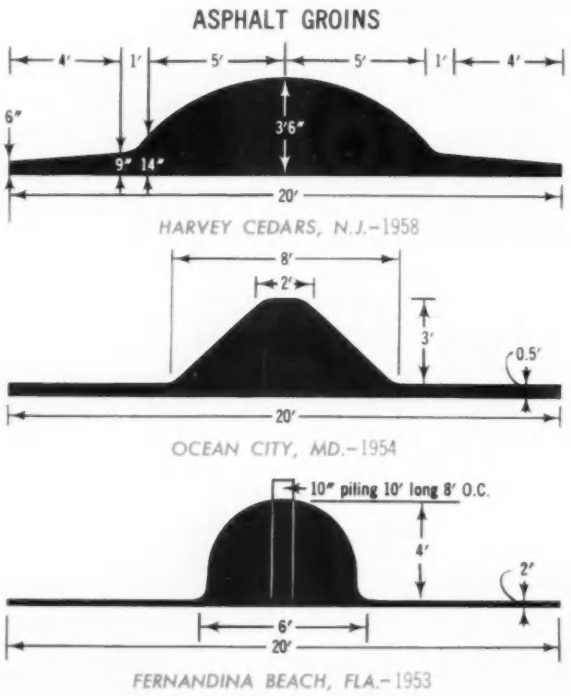
The construction method followed the procedure developed on the Maryland project, with minor variations. Bulldozers ploughed a trench from a point two hundred feet above low water down to the mean low water mark. Straw was then placed directly on the subgrade sand and a six-inch blanket of gravel was spread on the straw by dozer.

Construction of the asphalt groin was started at mean low tide at the seaward end of the excavation using a modified version of the Maryland mix design recommended by The Asphalt Institute. This mixture was composed of approximately 41 percent coarse aggregate (retained on the No. 8 sieve), 45 percent fine aggregate, five percent filler added and nine percent of 60-70 penetration asphalt. Temperature of the mix placed at the toe was 300°F, but this temperature was lowered gradually to 275°F as work progressed up the

1. Operating at low tide, bulldozer ploughs wide trench from dune line to water's edge, building temporary sand dike against turning tide.

2. Now trucks pour hot mix into shallows as crew rapidly fashions the tongue of the groin and begins working back in a race against tide.

3. Completed structure after several weeks exposure to wind and waves shows effectiveness of groin with sand already building around it.



slope of the beach. Similarly, the asphalt and portion passing the No. 200 sieve in the mix was lowered from nine percent of each at the seaward end to seven percent at the dune line.

DESIGN ALTERED

In silhouette, the design of the Harvey Cedars groin differs noticeably from those installed at Ocean City. In profile it follows a broad arc which spans a ten-foot base line where the Maryland design called for a steeper slope from an eight-foot base line to a narrow crest.

Plant production lagged, due to the inclement weather, yet the work schedule was maintained on the first groin. Banks were frozen solid at the gravel pit and had to be thawed by burning logs. Two loads of aggregate froze in the truck bodies. On the second day, delivery of hot mix from the straining asphalt plant slowed to a crawl when the blinding snow storm swept across the haul route, braking the fleet of 18 haul trucks to a snail's pace.

At this point, engineers Frank Sleeper and Roger Vorhees buttoned up their parkas and decided to button up the whole project until spring.

Meanwhile, the first experimental installation is emerging from its first winter buffeting in good shape. Sand accretion has virtually buried the groin, a pretty good sign that the asphalt mass is performing its expected function.

BLACK INLAYS

Asphalt Capping for Cellular Breakwater on Lake Huron

Another example of how the impermeable quality of asphalt mixtures offers a versatile tool in the relentless war between man and sea. Asphalt-capped and steel-clad cells guard entrance to Port Austin.

CAPPING the 133 steel cells of the new Port Austin, Michigan, breakwater last fall was an exercise in bituminous dentistry of magnificent proportions. The individual cells, representing twenty miles of sheet steel and containing 24,000 cubic yards of gravel fill, have the appearance of giant bicuspids biting their way up through the shallows of Lake Huron.

The asphalt cap consists of a prime coat on the compacted gravel, two inches of sand-asphalt mix base course, tacked and finished off with another two inches of the same dense mix.

MIX TRUCKED 42 MILES

The mix, heated to about 350°F, was trucked a distance of 42 miles from the plant in insulated trucks which held the mix temperature to within ten degrees of heat loss during the trip. The trucks, using a temporary dredged road that followed the curvature of the breakwater, dumped their loads into a box from which the mix was lifted by clam bucket to the tops of the cells.

The material was spread by rake and shovel, after which vibrating hand compactors were used for final densification. Accompanying photograph shows this operation, with a view of the completed project with the temporary service road that later was removed by dredge.

Called the "100 Curve Road," this winding drive climbs to lovely shrine on the shore of a lake in Nikko National Park near Tokyo.

DISCIPLINED thinking usually produces patterns, and where engineering discipline is applied patterns are the inevitable end-product. On this page are pictured a variety of patterns, each the product of a paving engineer's planning. Each pattern, in its own way, reflects its point of origin. The graceful curves of the Japanese road, the breadth and sweep of America's West in the Colorado highway, and the neat geometry of the Florida housing development, or the carefully labeled lab specimens at The Asphalt Institute.

Asphalt Arabesque

This is an aerial view of the Fountain Interchange on Colorado Interstate Route 85, about 15 miles south of Colorado Springs.

Daily scores of laboratory specimens like these are made, then methodically destroyed by rigid tests at The Asphalt Institute.

Latest addition to the rapidly increasing number of satellite real estate developments in Ft. Lauderdale, Florida, is Coral Ridge with its bungalows and asphalt-paved streets and drives.

ASPHALT AHOY!

The hot-mix lining is fed into barges by clam-bucket (above), and compacted by 10-ton roller put aboard by crane (center). After year's duty (below) lining is still an effective buffer.

WHAT has a steel hull, asphalt-paved deck, and flies? The answer, a switch on a tired old vaudeville gag, is: "A New York City garbage scow."

Disposing of the refuse of a city of eight million persons is a fairly monumental problem in logistics, and it keeps a fleet of forty huge barges battling the waves around Manhattan Island. Naturally, when any of these scows has to be hauled out of service for hull patching, the municipal garbage pail threatens to overflow.

And when one of those 14-ton loading buckets punches a hole in the old-style false deck, they also hammer quite a dent in the Department of Sanitation budget. That's why the Department, after mulling over its problem with The Asphalt Institute, decided to try lining the bottom of a few barges with asphalt concrete as a shock absorber.

In designing an appropriate asphalt mix for this unusual job, it was determined that the pavement should combine the features of a highway design mix and a hydraulic mix—the high stability of a highway pavement to absorb the impact of the falling bucket, and the special features of a hydraulic mix to contend with the ever-present moisture.

A soft grade of asphalt was recommended to reduce the possibility of cracking under the torsion stresses of the hull. Also, it was recognized that the material would have to be as impermeable as possible. A penetration grade of 120-150 was used.

MIX HAND SPREAD

The paving mixture was dumped on a dockside pan, then transferred by clam bucket into the hold of the scow where it was hand spread and compacted with a ten-ton roller. Vibrators were tried, but discontinued when they showed a tendency to displace rather than compact the mixture. All the edges were sealed with a hot asphalt cement of the same grade used in the mix.

Ten barges were asphalt-lined during the spring and summer of 1956 and and five new scows, similarly treated, were added to the fleet last year. At the same time, five other new scows with 1¼" plate steel decking were placed in service for comparison purpose.

Fifteen of the scow fleet have received this treatment and the first experimental models are rounding out their third year of service this spring. According to Mr. Murray Herman, the Department's Deputy Director of Engineering, it's still a little early to measure the effectiveness of the buffer pavement but he reports no complaints from the crews.

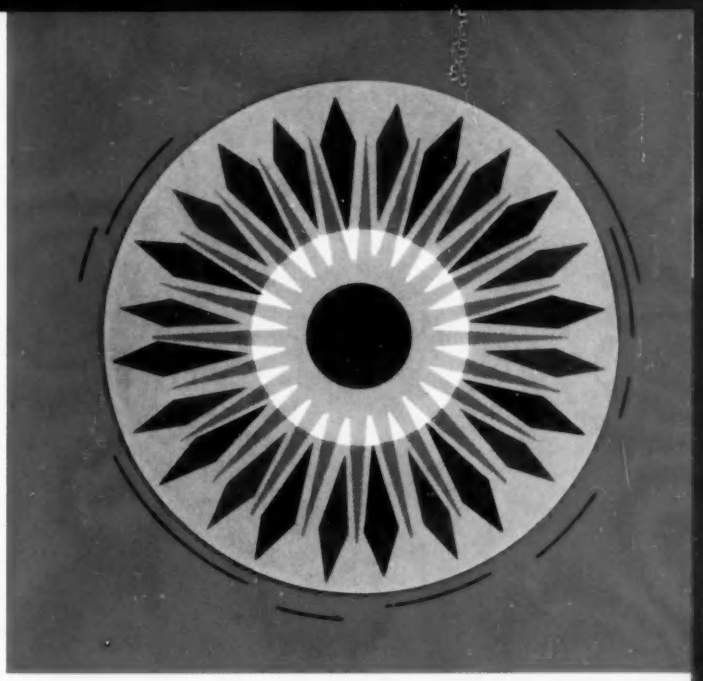
Mr. Herman reports that it isn't economically practical to scrape bottom when the scows are unloaded at Staten Island. A carpet of litter, about two feet deep, is left in the hold and the barge goes plodding back to work. But he's planning to do a complete broom and shovel job on one of the three-year-old decks sometime this year and make a close examination of the asphaltic surface.

New York's busy garbage scows lined with ASPHALT

NEVADA

BETS THE ROLL ON BLACK

Chip seal shoulders offer a bright contrast to the dark driving lanes.



NOT since the old Comstock days has so much earth been moved in Nevada, and so profitably—if profit can be translated in terms of silver dollar savings.

The state, long familiar with the engineering economics of modern asphalt paving, is well along the way to wrapping up its segment of the Interstate system swiftly and economically. Already completed as winter closed down were 11.82 miles of I-road at a cost of $4.3 million and another 22.55 miles were being built at a cost of $6.1 million. Lined out for construction are another 112 miles at an estimated cost of $58 million.

Typical of the construction that features the new Interstate roads in Nevada is the six-mile project completed last year on U. S. 40 east of Sparks.

A new gravel base, ranging in depth from eight to 16 inches, was primed, then capped with three and one-half inches of ¾-inch maximum dense graded asphalt concrete placed in two courses. Over this went a half-inch wearing course of open graded asphalt concrete. Shoulders were surfaced with a chip seal which offers an excellent contrast with the driving lanes.

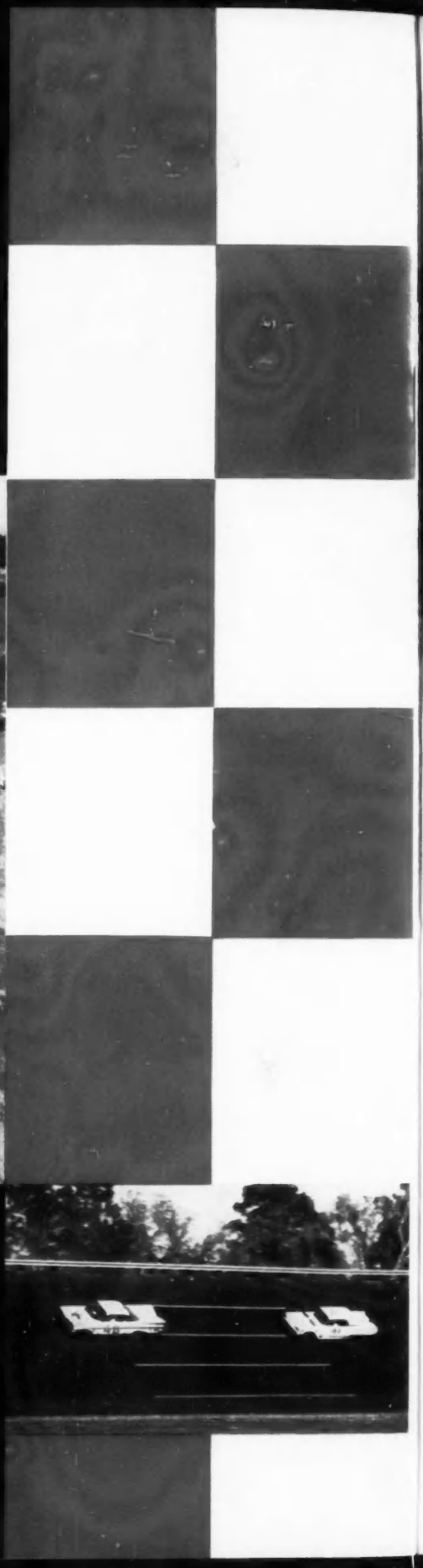
An unusual feature of the project was the treatment of the slopes in the sandy cuts to prevent wind and water erosion. The slopes were treated with an asphalt emulsion at a rate of approximately 0.5 gallons per square yard.

Nevada is pushing its highway program with one eye cocked at the upcoming winter Olympic games at nearby Squaw Valley. Already the state has rammed a magnificent new highway up the rugged face of the Sierra Nevadas to Lake Tahoe on the California line. This broad, new, asphalt-paved highway on the Clear Creek grade will lure thousands of visitors down into the friendly valleys and the quicksilver temples of chance at Reno and Las Vegas.

Similarly, the new project that follows the burbling Truckee River on U. S. 40 is a welcome mat of smooth-riding asphalt, rolled out to greet the incoming traveler from the East.

Asphalt Paves

WORLD'S FASTEST RACE TRACK



DAYTONA INTERNATIONAL SPEEDWAY
THE TALK OF AUTO RACING WORLD

Ingenious I bar arrangement with "floating" screed was devised to pave the 31-degree slopes.

BY NIGHTFALL on April 4, the title of world's fastest racetrack is expected to have passed from the concrete-paved oval at Monza, Italy, to the asphalt-paved tri-oval at Daytona Beach, Florida.

Two 100-mile tests for the Indianapolis-type roadsters should produce average speeds of 175 miles an hour, and the single lap record is expected to start knocking on the door of 200 mph. The record average speed at Monza stands at 166 miles an hour and Monza's record for a single lap is 177 miles per hour. At Indianapolis the single lap record is exactly 148.148 mph.

STOCKS SET RECORD

The magnificent new speedway at Daytona Beach was formally unwrapped in February for Daytona's annual Speed Week, a stock car classic. On this occasion, the factory-built cars topped 143 miles an hour in tune-up whirls around the course and in the official 500-mile stock race, a photo finish was clocked at an average of 135.52 miles an hour—the fastest time ever recorded for the assembly line models.

Lee Petty who jockeyed a 1959 Oldsmobile home a winner by a hair's breadth was bubbling with enthusiasm about the asphalt pavement.

"With those white lines standing out against the dark pavement, I hit those banked turns all out and couldn't tell the difference from the flat straightaway," he exclaimed. "The tires just hung on that pavement like I was on tracks."

Paving the 2.5 mile tri-oval was a triumph of "imagineering" by Contractor A. P. "Pat" Bolton of Lakeland, Florida. Standard paving techniques couldn't handle the assignment of surfacing the 31-degree banked curves at both ends of the long back stretch.

To solve this tricky problem, Bolton employed what might literally be described as a "floating" screed, suspended between two finishing machines that functioned only as mobile guides. He broke the screed away from a Cedar Rapids electric finisher. Then, he stationed the Cedar Rapids machine at the base of the curve and placed a Barber-Greene finisher on the rim, linking the two machines with an I-beam on which the electric screed rode. The beam was slotted to accommodate the screed in four positions making it possible to pave the bank in four ten-foot increments.

The hot mix was fed directly to the hopper of the screed by sluice, then fed through the screed past a battery of baffles. This was an innovation developed by trial and error. First attempts to lay the mix with standard worm gear feeder failed. The mix tended to crowd to the low side of the screed. So Bolton removed the worm gear and installed a system of baffles for directing the paving mixture into the electric vibrating screed.

MONUMENT TO SPEED

The structural design of the racing pavement called for eight inches of lime-rock base with three inches of asphalt concrete binder and surface. The binder course used was a Grade 13, Florida specification and a denser Grade 16 mixture was employed for the surface course, both mixes using a Birmingham slag aggregate.

Rolling on the 31-degree slopes was conducted with an eight-ton roller suspended by cable from a bulldozer on the rim of the embankment.

The Daytona plant is a real monument to speed. In addition to the warped oval for the big cars, the layout also features a 4.5-mile sports car course which weaves around the infield for a couple of miles, then borrows the big saucer for a lap. Paving of the interior track was completed a week ago in preparation for the first big sports car event on April 5, right in behind the Indianapolis racers.

THE WINNER!

—and still champion

(This account of the seven-year performance record of the New Jersey Turnpike is based on a paper presented before the Highway Research Board in January 1959, by Mr. Harold W. Goldberger, Assistant Engineer of Maintenance.)

LAST YEAR 41 million automobiles, buses and trucks streamed over the New Jersey Turnpike—King of the Toll Roads.

In the seven years since the road was opened to traffic, more than 203 million vehicles have rolled up an incredible traffic record on what is, by all odds, the most successful stretch of pavement ever laid down. In two short years of operation, traffic and toll revenues soared beyond the original engineering estimates for 1975. And every year since has seen new records set.

According to sober engineering appraisals, the turnpike in 1956 already had put in the equavalent of 34 years of service at normal anticipated volume of traffic.

ASPHALT TRIUMPH

What is the secret of the success of this modern superhighway? Basically, of course, it was the decision to pave the road with heavy-duty asphalt concrete. The 118-mile toll road was built in a record time of less than two years and at a saving of $5.4 million, based on competitive alternate bidding for slab pavement.

In addition to the speed and obvious economic advantage of heavy-duty asphalt paving, other factors entered into the decision for asphalt. Engineers recognized that materials used in this type of structure would be least affected by the then critical materials situation brought about by the Korean War; also, that only this type of construction could effectively cope with unusual problems confronting them especially in the northern section, where the turnpike cuts across the Jersey marshes. Here, soft deposits as much as 100 feet deep presented a major problem for both highway and bridge construction. Vertical sand drains proved the answer to this soggy problem, however, and made possible the early paving and opening of the northern section of the turnpike, which otherwise might have been delayed for years.

The nature of the Jersey marshes and the short period of time allowed for completion of the turnpike did not permit effective stabilization in all "soft" areas. Where settlement occurred, profile restoration was easily accomplished by resurfacing with asphalt concrete. This operation began in 1954 and continues to the present, but in considerably lesser degree. From 48 thousand square yards of hot mix used in 1954 for this purpose to four thousand square yards in 1958 is a good indication that settlement, while continuing, is slowing down appreciably.

SLAB SETTLEMENT PROBLEM

Slab settlement on the approaches to the bridges has offered a costly and troublesome problem. It has been necessary to raise them to original elevation by mud-jacking, or to reduce the peaks by sawing or pavement breaking, before resurfacing them with asphalt concrete. Because of the hand labor involved, either method has proved expensive.

Some longitudinal cracking developed in the fill areas adjacent to the bridges, and in the sand drain area in 1956. Water trapped in the subbase or in the penetrated macadam base is believed responsible. Similarly, some longitudinal cracking also developed into the center lane in fill areas where a third traffic lane was added in 1955. This may be traced to loss of lateral support during the widening operation.

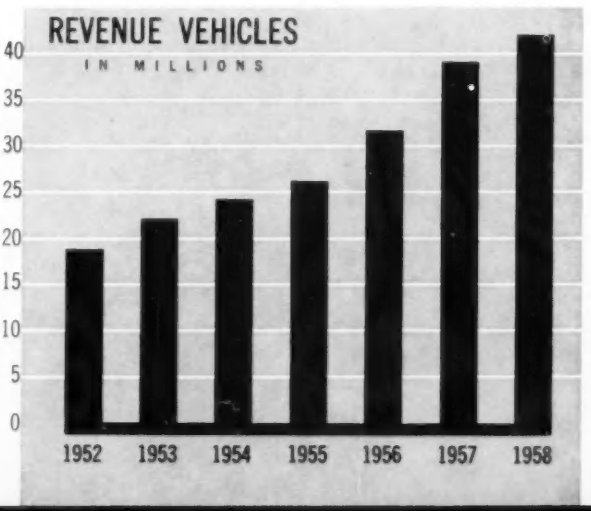
A treatment of rapid-setting asphalt emulsion covered with a sharp, hard stone sand has proven effective in sealing these cracks.

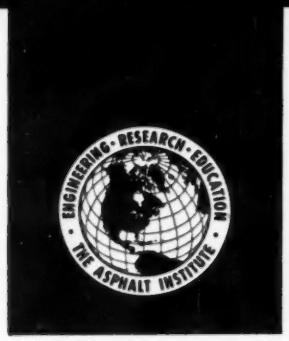
There also has been slight channelization and grooving, especially in the outside lane which carries most of the heavy truck traffic. However, the condition has not yet become serious enought to require immediate corrective action. Turnpike authorities expect to employ a silica sand asphalt mixture to restore these longitudinal grooves to correct profile. This type of "spot" surfacing, with neatly feathered edges, has been used with considerable success in some local patching operations.

DESIGN PROVED ADEQUATE

In summary, the performance of the New Jersey Turnpike over a span of seven years has demonstrated that the design is adequate in spite of a traffic load which is unprecedented in highway history. Now the engineers charged with the custody of this model road are turning their full attention to the problem of maintaining the highway in first class condition to go on serving its millions of annual users for decades to come.

It is the type of challenge which an asphalt-paved road welcomes, and one which offers another opportunity to prove that a properly designed and constructed asphalt pavement *can* be maintained—easily, economically and almost indefinitely.





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